Answer to Some Selected Problems

UNIT 1

1.17 ~ 15×10^{-4} g , 1.25×10^{-4} m
1.18 (i) 4.8×10^{-3} (ii) 2.34×10^{5} (iii) 8.008×10^{3} (iv) 5.000×10^{2}
(v) 6.0012
1.19 (i) 2 (ii) 3 (iii) 4 (iv) 3
(v) 4 (vi) 5
1.20 (i) 34.2 (ii) 10.4 (iii) 0.0460 (iv) 2810
1.21 (a) law of multiple proportion (b) (i) Ans : (10^{6} mm, 10^{15} pm)
(ii) Ans : (10^{-6} kg, 10^{6} ng)
(iii) Ans : (10^{-3} L, 10^{-3} dm^{3})
1.22 6.00×10^{-1} m =0.600 m
1.23 (i) B is limiting (ii) A is limiting
(iii) Stoichiometric mixture –No (iv) B is limiting
(v) A is limiting
1.24 (i) 2.43×10^{3} g (ii) Yes
(iii) Hydrogen will remain unreacted; 5.72×10^{2}g
1.26 Ten volumes
1.27 (i) 2.87×10^{-11}m (ii) 1.515×10^{-11} m (iii) 2.5365×10^{-2}kg
1.30 1.99265×10^{-23}g
1.31 (i) 3 (ii) 4 (iii) 4
1.32 39.948 g mol^{-1}
1.33 (i) 3.131×10^{25} atoms (ii) 13 atoms (iii) 7.8286×10^{24} atoms
1.34 Empirical formula CH, molar mass 26.0 g mol^{-1}, molecular formula C_2H_2
1.35 0.94 g $CaCO_3$
1.36 8.40 g HCl

UNIT 2

2.1 (i) 1.099×10^{27} electrons (ii) 5.48×10^{-7} kg, 9.65×10^{4}C
2.2 (i) 6.022×10^{24} electrons
(ii) (a) 2.4088×10^{21} neutrons (b) 4.0347×10^{-6} kg
(iii) (a) 1.2044×10^{22} protons (b) 2.015×10^{-5} kg
2.3 7,6: 8,8: 12,12: 30,26: 50, 38
2.4 (i) Cl (ii) U (iii) Be
2.5 5.17×10^{14} s^{-1}, $1.72 \times 10^{6}m^{-1}$
2.6 (i) 1.988×10^{-18} J (ii) 3.98×10^{-15} J

2.7 6.0×10^{-2} m, 5.0×10^{9} s^{-1} and 16.66 m^{-1}

2.8 2.012×10^{16} photons

2.9 (i) 4.97×10^{-19} J (3.10 eV); (ii) 0.97 eV (iii) 5.84×10^{5} m s^{-1}

2.10 494 kJ mol^{-1}

2.11 $7.18 \times 10^{19} s^{-1}$

2.12 $4.41 \times 10^{14} s^{-1}$, 2.91×10^{-19}J

2.13 486 nm

2.14 8.72×10^{-20}J

2.15 15 emission lines

2.16 (i) 8.72×10^{-20}J (ii) 1.3225 nm

2.17 1.523×10^{6} m^{-1}

2.18 2.08×10^{-11} ergs, 950 Å

2.19 3647Å

2.20 3.55×10^{-11}m

2.21 8967Å

2.22 Na^{+}, Mg^{2+}, Ca^{2+}; Ar, S^{2-} and K^{+}

2.23 (i) (a) $1s^2$ (b) $1s^2\ 2s^2\ 2p^6$; (c) $1s^2 2s^2 2p^6$ (d) $1s^2 2s^2 2p^6$

2.24 n = 5

2.25 n = 3; l = 2; m_l = –2, –1, 0, +1, +2 (any one value)

2.26 (i) 29 protons

2.27 1, 2, 15

2.28 (i)

l	m_l
0	0
1	–1,0,+1
2	–2,–1,0,+1,+2

(ii) l = 2; m_l=–2, –1,0,+1,+2

(iii) 2s, 2p

2.29 (a) 1*s*, (b) 3*p*, (c) 4*d* and (d) 4*f*

2.30 (a), (c) and (e) are not possible

2.31 (a) 16 electrons (b) 2 electrons

2.33 n = 2 to n = 1

2.34 8.72×10^{-18}J per atom

2.35 1.33×10^{9}

2.36 0.06 nm

2.37 (a) 1.3×10^{2} pm (b) 6.15×10^{7} pm

2.38 1560

2.39 8

2.40 More number of K–particles will pass as the nucleus of the lighter atoms is small, smaller number of K–particles will be deflected as a number of positve charges is less than on the lighter nuclei.

2.41 For a given element the number of prontons is the same for the isotopes, whereas the mass number can be different for the given atomic number.

2.42 $^{81}_{35}Br$

2.43 $^{37}_{17}Cl^{-1}$

2.44 $^{56}_{26}Fe^{3+}$

2.45 Cosmic rays > X–rays > amber colour > microwave > FM

2.46 3.3×10^{6} J

2.47 (a) 4.87×10^{14} s^{-1} (b) 9.0×10^{9} m (c) 32.27×10^{-20} J
(d) 6.2×10^{18} quanta

2.48 10

2.49 8.28×10^{-10} J

2.50 3.45×10^{-22} J

2.51 (a) Threshold wave length 652.46 nm (b) Threshold frequency of radiation 4.598×10^{14} s^{-1}
(c) Kinetic energy of ejected photoelectron 9.29×10^{-20} J, Velocity of photoelectron 4.516×10^{5} ms^{-1}

2.52 530.9 nm

2.53 4.48 eV

2.54 7.6×10^{3} eV

2.55 infrared, 5

2.56 434 nm

2.57 455 pm

2.58 494.5 ms^{-1}

2.59 332 pm

2.60 1.516×10^{-38} m

2.61 Cannot be defined as the actual magnitude is smaller than uncertainity.

2.62 (v) < (ii) = (iv) < (vi) = (iii) < (i)

2.63 4*p*

2.64 (i) 2*s* (ii) 4d (iii) 3p

2.65 Si

2.66 (a) 3 (b) 2 (c) 6
(d) 4 (e) zero

2.67 16

UNIT 5

5.1 (ii)

5.2 (iii)

5.3 (ii)

5.4 (iii)

5.5 (i)

5.6 (iv)

5.7 q = + 701 J
w = – 394 J, since work is done by the system
ΔU = 307 J

5.8 –743.939 kJ

5.9 1.067 kJ

5.10 $\Delta H = -7.151$ kJ mol^{-1}

5.11 – 314.8 kJ
5.12 $\Delta_r H = -778$ kJ
5.13 – 46.2 kJ mol^{-1}
5.14 – 239 kJ mol^{-1}
5.15 326 kJ mol^{-1}
5.16 $\Delta S > 0$
5.17 2000 K
5.18 ΔH is negative (bond energy is released) and ΔS is negative (There is less randomness among the molecules than among the atoms)
5.19 0.164 kJ, the reaction is not spontaneous.
5.20 –5.744 kJ mol^{-1}
5.21 NO(g) is unstable, but NO_2(g) is formed.
5.22 $q_{surr} = +\ 286$ kJ mol^{-1}
$\Delta S_{surr} = 959.73$ J K^{-1}

UNIT 6

6.2 12.229
6.3 2.67×10^4
6.5 (i) 4.33×10^{-4} (ii) 1.90
6.6 1.59×10^{-15}
6.8 $[N_2] = 0.0482$ $molL^{-1}$, $[O_2] = 0.0933$ $molL^{-1}$, $[N_2O] = 6.6 \times 10^{-21}$ $molL^{-1}$
6.9 0.0352mol of NO and 0.0178mol of Br_2
6.10 7.47×10^{11} M^{-1}
6.11 4.0
6.12 $Q_c = 2.379 \times 10^3$. No, reaction is not at equilibrium.
6.14 0.44
6.15 0.068 $molL^{-1}$ each of H_2 and I_2
6.16 $[I_2] = [Cl_2] = 0.167$ M, $[ICl] = 0.446$ M
6.17 $[C_2H_6]_{eq} = 3.62$ atm
6.18 (i) $[CH_3COOC_2H_5][H_2O] / [CH_3COOH][C_2H_5OH]$
(ii) 3.92 (iii) value of Q_c is less than K_c therefore equilibrium is not attained.
6.19 0.02$molL^{-1}$ for both.
6.20 $[P_{CO}] = 1.739$atm, $[P_{CO2}] = 0.461$atm.
6.21 No, the reaction proceeds to form more products.
6.22 3×10^{-4} $molL^{-1}$
6.23 0.149
6.24 a) – 35.0kJ, b) 1.365×10^6
6.27 $[P_{H_2}]_{eq} = [P_{Br_2}]_{eq} = 2.5 \times 10^{-2}$bar, $[P_{HBr}] = 10.0$ bar
6.30 b) 120.48
6.31 $[H_2]_{eq} = 0.96$ bar
6.33 2.86×10^{-28} M
6.34 $5.85 x 10^{-2}$
6.35 NO_2^-, HCN, ClO_4, HF, H_2O, HCO_3^-, HS^-
6.36 BF_3, H^+, NH_4^+

6.37 F^-, HSO_4^-, CO_3^{2-}

6.38 NH_3, NH_4^+, HCOOH

6.41 2.42

6.42 1.7×10^{-4}M

6.43 $F^- = 1.5 \times 10^{-11}$, $HCOO^- = 5.6 \times 10^{-11}$, $CN^- = 2.08 \times 10^{-6}$

6.44 [phenolate ion]= 2.2×10^{-6}, $\alpha = 4.47 \times 10^{-5}$, α in sodium phenolate = 10^{-8}

6.45 $[HS^-] = 9.54 \times 10^{-5}$, in 0.1M HCl $[HS^-] = 9.1 \times 10^{-8}$M, $[S^{2-}] = 1.2 \times 10^{-13}$M, in 0.1M HCl $[S^{2-}] = 1.09 \times 10^{-19}$M

6.46 $[Ac^-]$= 0.00093, pH= 3.03

6.47 $[A^-] = 7.08 \times 10^{-5}$M, $K_a = 5.08 \times 10^{-7}$, pK_a= 6.29

6.48 a) 2.52 b) 11.70 c) 2.70 d) 11.30

6.49 a) 11.65 b) 12.21 c) 12.57 c) 1.87

6.50 pH = 1.88, pK_a = 2.70

6.51 $K_b = 1.6 \times 10^{-6}$, pK_b = 5.8

6.52 $\alpha = 6.53 \times 10^{-4}$, $K_a = 2.35 \times 10^{-5}$

6.53 a) 0.0018 b) 0.00018

6.54 α = 0.0054

6.55 a) 1.48×10^{-7}M, b) 0.063 c) 4.17×10^{-8}M d) 3.98×10^{-7}

6.56 a) 1.5×10^{-7}M, b) 10^{-5}M, c) 6.31×10^{-5}M d) 6.31×10^{-3}M

6.57 $[K^+] = [OH^-]$ = 0.05M, $[H^+] = 2.0 \times 10^{-13}$M

6.58 $[Sr^{2+}]$ = 0.1581M, $[OH^-]$ = 0.3162M, pH = 13.50

6.59 $\alpha = 1.63 \times 10^{-2}$, pH = 3.09. In presence of 0.01M HCl, $\alpha = 1.32 \times 10^{-3}$

6.60 $K_a = 2.09 \times 10^{-4}$ and degree of ionization = 0.0457

6.61 pH = 7.97. Degree of hydrolysis = 2.36×10^{-5}

6.62 $K_b = 1.5 \times 10^{-9}$

6.63 NaCl, KBr solutions are neutral, NaCN, $NaNO_2$ and KF solutions are basic and NH_4NO_3 solution is acidic.

6.64 (a) pH of acid solution= 1.9 (b) pH of its salt solution= 7.9

6.65 pH = 6.78

6.66 a) 12.6 b) 7.00 c) 1.3

6.67 Silver chromate S= 0.65×10^{-4}M; Molarity of $Ag^+ = 1.30 \times 10^{-4}$M
Molarity of $CrO_4^{2-} = 0.65 \times 10^{-4}$M; Barium Chromate S = 1.1×10^{-5}M; Molarity of Ba^{2+} and CrO_4^{2-} each is 1.1×10^{-5}M; Ferric Hydroxide S = 1.39×10^{-10}M;
Molarity of $Fe^{3+} = 1.39 \times 10^{-10}$M; Molarity of $[OH^-] = 4.17 \times 10^{-10}$M
Lead Chloride S = 1.59×10^{-2}M; Molarity of $Pb^{2+} = 1.59 \times 10^{-2}$M
Molarity of $Cl^- = 3.18 \times 10^{-2}$M; Mercurous Iodide S = 2.24×10^{-10}M;
Molarity of $Hg_2^{2+} = 2.24 \times 10^{-10}$M and molarity of $I^- = 4.48 \times 10^{-10}$M

6.68 Silver chromate is more soluble and the ratio of their molarities = 91.9

6.69 No precipitate

6.70 Silver benzoate is 3.317 times more soluble at lower pH

6.71 The highest molarity for the solution is 2.5×10^{-9}M

6.72 2.43 litre of water

6.73 Precipitation will take place in cadmium chloride solution

NOTES